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(19) **United States**(12) **Patent Application Publication****Noori et al.**(10) **Pub. No.: US 2017/0117754 A1**(43) **Pub. Date: Apr. 27, 2017**(54) **WIRELESS CHARGING AND COMMUNICATIONS SYSTEMS WITH DUAL-FREQUENCY PATCH ANTENNAS**(52) **U.S. CL.**
CPC **H02J 50/23** (2013.01)(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(57) **ABSTRACT**(72) Inventors: **Basim H. Noori**, San Jose, CA (US);
Khan M. Salam, Dublin, CA (US);
Liang Han, Sunnyvale, CA (US);
Matthew A. Mow, Los Altos, CA (US);
Mattia Pascolini, San Francisco, CA (US);
Ruben Caballero, San Jose, CA (US);
Thomas E. Biedka, San Jose, CA (US);
Yi Jiang, Sunnyvale, CA (US);
Yuehui Ouyang, Sunnyvale, CA (US)(21) Appl. No.: **14/921,895**(22) Filed: **Oct. 23, 2015****Publication Classification**(51) **Int. CL.**
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An electronic device may be provided with wireless circuitry. The wireless circuitry may include one or more dual-frequency dual-polarization patch antennas. Each patch antenna may have a patch antenna resonating element that lies in a plane and a ground that lies in a different parallel plane. The patch antenna resonating element may have a first feed located along a first central axis and a second feed located along a second central axis that is perpendicular to the first central axis. The patch antenna resonating element may be rectangular, may be oval, or may have other shapes. A shorting pin may be located at an intersecting point between the first and second axes. The patch antennas may be used in beam steering arrays. The patch antennas may be used for wireless power transfer at microwave frequencies or other frequencies and may be used to support millimeter wave communications.

